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Research Article

Emergency Surgical Treatment of Ankle Fractures

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Received Date: January 13, 2025; **Accepted Date:** January 20, 2025; **Published Date:** January 27, 2025

Citation: Horacio T. Neyra, (2025), Emergency Surgical Treatment of Ankle Fractures, *J. Clinical Orthopedics and Trauma Care*, 7(1); **DOI:**10.31579/2694-0248/120

Abstract

Ankle fractures are common injuries whose treatment aims to restore stability and alignment of the joint to reduce the risk of post-traumatic ankle arthritis. Objective: To evaluate the effect of emergency surgical treatment on the outcome of patients diagnosed with ankle fractures, one year after its completion.

Results: There was a predominance of males over females (64.78% vs 35.22%) with a mean age of 43.4 ± 3.5 years, 18 patients were on anticoagulant therapy. A high percentage of our patients (95.8%) had an anesthetic risk equal to or less than ASA III. 16 fractures were open (22.5%); 26.7% (19 patients) were classified as transsyndesmal injuries, type B of the Dannis-Weber classification, complications were minimal, with AOFAS and VAS results considered excellent. Conclusions: The one-year results in patients over 18 years of age with ankle fracture, using the AOFAS criteria, the visual pain scale and incorporation into daily life activities as evaluators, can be classified as excellent.

Keywords: ankle fractures; emergency surgical treatment

Introduction

Ankle fractures are common injuries that may result from a trivial twisting injury in elderly and frail patients or from high-energy trauma in a younger population. The treatment of these fractures aims to restore stability and alignment of the joint to reduce the risk of post-traumatic ankle arthritis.[**1]**

Ankle fractures are of great importance both in relation to the joint itself (the one that carries the greatest weight in human anatomy) but also in terms of restoring mobility and independence to any individual.[**1,2]** Ankle fractures are among the most common bone injuries of the lower limb and are a major source of mobility disorders.[**3]** These fractures are common injuries. Currently, their incidence is between 100 and 200 fractures per 100,000 person-years. Isolated fractures of the lateral malleolus are the most common, accounting for approximately 70% of all ankle fractures.[**4]** Several classifications have been proposed, none of which seem to adequately cover the entire spectrum of these injuries. The Danis-Weber and AO/OTA classifications describe the anatomy of the fracture configuration.[**5,6**]

Malleolar fractures may range from an isolated lateral malleolar fracture with minimal displacement to a trimalleolar fracture with dislocation and vascular compromise. Isolated fractures of the lateral malleolus are the most common (approximately 70% of all malleolar fractures). Ankle fractures are associated with soft tissue injuries involving the medial (e.g., deltoid) or lateral (e.g., anterior talofibular and calcaneofibular) ligaments, syndesmosis, tibiofibular ligaments, and articular cartilage. [**7-9**]

Ankle fractures are treated surgically or conservatively and are routinely followed by physical therapy treatment after a period of immobilization.[**10]** The costs to individuals and the health care system can be significant. For example, the estimated total costs for treating an ankle fracture over a 24-week period from the start of physical therapy treatment were estimated at $735 per person, including $412 in direct costs to the public health system and $323 in out-of-pocket costs.[**11]** In addition to these out-of-pocket costs, patients are estimated to experience an average of 70 days of work absence after an ankle fracture.**12** In the United States, 34% of people with ankle fractures were reported to have lost their jobs due to the injury.[**11-14**]

Surgical factors include proper patient selection, timing of surgery, surgical approaches, type of implant, and appropriate rehabilitation program. Despite the invention of new devices, surgical techniques, and biomechanical studies for restoration and maintenance of a congruent ankle joint after ankle fractures, several aspects of treatment of these injuries remain controversial.**15** Regardless of the method of intervention, the primary goal is restoration of normal anatomy to achieve normal biomechanics, painless function, and to prevent long-term post-traumatic degeneration. Surgical treatment carries a potential risk of complications, such as nonunion, implant failure, and soft tissue-related complications.[**16-19**]

The AO technique with lateral fibula plating to neutralize an interfragmentary lag screw has been common practice for over 50 years, but advances in implant technology as well as new treatment strategies have provided surgeons with more options. [**20-24]** However, although several

fixation techniques have been described, the optimal treatment strategy for these injuries remains unclear.**[25-27]**

Our aim was to evaluate the effect that emergency surgical treatment has on the outcome of patients diagnosed with ankle fractures, one year after its completion.

Material & Methods

An observational, descriptive and prospective study was carried out with a cohort of patients over 18 years of age, treated and surgically intervened between January 1, 2018 and May 31, 2023, who were diagnosed with a displaced ankle fracture, treated urgently surgically at the "Calixto García" Hospital and evaluated one year later. The sample consisted of 71 patients, 25 women and 46 men who met the selection criteria used.

Results

In accordance with the stated purpose, 71 patients were recruited sequentially, of which 46 were men (64.78%) and 25 women (35.22%) with a mean age of 43.4 ± 3.5 years. There was a predominance of women in the age group over 60 years (52.0%), while men were predominantly between the ages of 18 and 49 years, with 34.7% in the group between 30 and 39 years. The mean body mass index found was 26 ± 3.7 Kg/m2.

Among other variables collected that could influence the results, there is the use of previous anticoagulant therapy and the regular intake of drugs, where as can be seen in the aforementioned table 1, 18 patients were taking anticoagulant therapy daily, (25.3% of the total sample). As regards the anesthetic risk according to the ASA classification, the majority of our patients were in ASA I (42 patients for 59.2% of the total). If we add to this that another 26 patients (36.6%) were in ASA II and ASA III levels, it can be deduced that a high percentage of our patients (95.8%) had an anesthetic risk equal to or less than ASA III. All of the above is visible in Table 1, which includes the biomedical variables of the sample. Table 1 itself shows that almost the majority of the patients in our sample had closed ankle fractures (55 for 77.5%), 39 had suprasyndesmal fractures (55%) which corresponds to type C of said classification.

Parameters	
Age*	43,4 ± 3,5 años
Sex	
Male	46 (64,78%)
Female	25 (35,22%)
Body mass index *	26 ± 3,7 Kg/m**2**
Anticoagulation therapy	
yes	18 (25,3%)
no	53 (74,7%)
Anesthetic Risk Classification (ASA)	
I	42 (59,2%)
II	18 (25,3%)
III	8 (11,3%)
IV	3 (4,2%)
Type of fracture (Dannis-Weber classification)	
A	13 (18,3%)
B	19 (26,7%)
C	39 (55,0%)
open	16 (22,5%)
closed	55 (77,5%)

Source: Data collection form.
* Average values are shown.

Table 1. Biomedical data of the sample

In order to specify the type of fracture according to the Dannis-Weber classification, due to its possible influence on the results assessed one year after surgery, we show in Table 2 the relationship between age groups and type of fracture found. The data shown in Table 2 show a higher incidence of type C fractures of the Dannis-Weber classification, followed by type B fractures, with 19; only 13 type A fractures were found, distributed fairly evenly among all age groups.

Age groups in years	Type of fracture (Dannis-Weber classification)						Total	
	A		B		C			
	No	%	No	%	No	%	No	%
18-29	2	15,4	4	21,0	8	20,4	14	19,7
30-39	2	15,4	8	42,2	9	23,5	19	26,8
40-49	3	23,0	3	15,8	6	15,3	12	16,9

50-59	**2**	**15,4**	**2**	**10,5**	**6**	**15,3**	**10**	**14,1**
60 y más	**4**	**30,8**	**2**	**10,5**	**10**	**25,5**	**16**	**22,5**
Total	**13**	**100,0**	**19**	**100,0**	**39**	**100,0**	**71**	**100,0**
% total	**18,3**		**26,8**		**54,9**		**100,0**	

Source: Data collection form.
Note: % of the total for each type of fracture.

Table 2. Age and type of fracture (Dannis-Weber).

Note that in the two peaks of incidence of ankle fractures in relation to age, 30-39 years and 60 years and older, the largest number of patients were in type C of the Dannis-Weber classification.

To facilitate understanding, we decided to divide the complications found into surgical complications, those related to the surgical procedure and its evolution; and non-surgical complications, which would be general complications whose greatest relationship, although not the only one, would be with the physical condition and comorbidities of these patients.

In Table 3, regarding surgical complications in the present study, 14 patients presented some postoperative complication (19.7%), and although these complications can be considered minor, this data must be taken into account. Five patients (7.0%) suffered from skin infection or scarring problems: three patients presented a superficial wound infection and two patients had skin necrosis, which were treated satisfactorily with local wound care and oral antimicrobials, without the need to remove the osteosynthesis material. The patients who suffered skin injury with necrosis coincided in the group of 18 who used previous anticoagulation therapy, which could be related to this complication. Three patients (4.2%) presented loosening of the osteosynthesis material during the postoperative year, which did not affect bone consolidation and it was necessary to remove part of the osteosynthesis material. One patient, one year after surgery, did not show precise radiographic signs of consolidation of the fibular malleolus, but since it was a Dannis-Weber C type fracture (suprasyndesmal) treated with a transsyndesmal screw, this delay did not influence the functional recovery of the joint and the patient.

Type of complications	No patients	%
Surgical		
Infection	3	4,2
Skin necrosis	2	2,8
Loosening of osteosynthesis material	3	4,2
Delayed consolidation	1	1,4
Non-surgical		
Urinary tract infection	4	5,6
Pneumonia	1	1,4
Cardiacs	2	2,8
Others	1	1,4

Source: data collection form.

Table 3. Post-surgical complications.

Table 3 also shows the non-surgical complications classified as such. It can be seen that four patients suffered from urinary tract infection, three men and one woman, who had a preoperative urinary catheter placed on the advice of the anesthesiologist. The four patients were treated according to the usual protocols for this type of infection and their condition resolved. One patient, over 60 years of age, developed pneumonia during the year, which required attention from the medical service, where he was discharged. Two patients had postoperative hypertensive crises, for which they were medicated by the internist; one had a mediate deep vein thrombosis in the postoperative period that was assessed and treated by the angiologist without major consequences.

The results obtained in relation to the evaluation of the results, according to the criteria declared in the methodology used, are shown in Table 4. According to the criteria of the American Orthopaedic Foot and Ankle Society (AOFAS), 53 patients were classified as having excellent results for 74.6%; 14 were classified as having good results, which adds up to a high 94.4% of results considered excellent and good (67 patients out of 71). Three patients showed a regular result and only one was considered to have a poor result according to these AOFAS criteria.

Regarding pain, the pain reported by the patients evaluated one year after their surgical treatment for ankle fractures was 3 ± 2 on the visual pain scale, which we consider to be a very good result since these patients were older adults. Once again, in accordance with the patients' reports, of this sample of 71 patients who underwent surgery for a diagnosis of ankle fracture, a high of 86% of them were able to carry out their daily life activities, which reflects an excellent functional incorporation.

Results according to evaluators used	
AOFAS (American Orthopaedic Foot and Ankle Society) Criteria	
Excellent	53 (74,7%)
Good	14 (19,7%)
Fair	3 (4,2%)
Bad	1 (1,4%)
Visual Pain Scale (VAS)*	3 ± 2
Activities of Daily Living *	70(98,6%)

Source: Data collection form.

*Mean and average values are shown.

Table 4. Results.

Discussion

Ankle fractures can be caused by various types of trauma, such as sprains, impacts, and crushes. The highest rates are found in men aged 15 to 24 years and in older women.[**28-30]** Unlike other fractures, its incidence in women is not related to osteoporosis, but to body mass index and frequency of falls.[**31-34]**

Boszczyk found that patients aged 18 to 39 years were the most frequent age group with ankle fractures; This group is the most physically active population and prone to all types of trauma. In that study, ankle fractures were more frequent in men than in women in all age groups.[**12]** Juto showed that the annual incidence of ankle fractures increased from 83 to 319 per 100,000 patients as the age of women increased from 30-39 to 60-69 years; men had a much more uniform distribution pattern. In this study, men were more often affected than women by nearly all types of ankle fractures, except isolated lateral malleolus fractures (M/F = 0.9) and trimalleolar fractures (M/F = 0.8).[**24]** So Hoo found that the average age was 51 years with 63% female.[**10]**

In his study, Schray found a mean age of 43.4 ± 3.5 years, with a ratio of 35.22% of women and 64.78% of men.**1** Tomé-Bermejo stated a mean age of 42.7 years and a sex ratio of 40% of women and 60% of men.[**1,3]**

In relation to body mass index, what was found here was very similar to that reported by Schray (26 ± 3.7 kg/m2).**1** Schray found that 17% of his patients used anticoagulant therapy.[**1]** Other studies show similar results in relation to the use of various medications in patients in the age group over 60 years, as well as in relation to the use of anticoagulant therapy.[**12-14]**

Shen's meta-analysis showed a clear predominance of ASA II anesthetic risk.[**16**]Schray found ASA II and III anesthetic risks, with 88% of his patients located in these stages.[**1]** In our study, ASA risk was found in classifications I, II, and III (59.2% and 36.6%, respectively).

Tome-Bermejo found 77.5% of type B fractures of the Weber classification and 17.5% of type C fractures in his series;[**3]** Other authors reviewed similarly report a greater predominance of Dannis-Weber type B transsidemal fractures.[**17-19]** There is the possibility of interobserver variations when classifying malleolar fractures, as mentioned by several authors.[**20-21]**

Danilkowicz in 2022 reported that postoperative complications increased with age and that smoking, diabetes, and being overweight increase the risk of complications; could not associate complications with a type of fracture, its complication rate was 5.6%.[**2]** So Hoo reported that the medium-term (<5-year) complication rate was low, with arthrodesis or ankle replacement in only 0.96% of patients. The type of fracture was a strong predictor of reoperation for ankle fusion or replacement.[**10**] Miller and Ovaska investigated risk factors for wound complications after ankle fracture surgery.[**23,30]** For Miller, 1.25% of patients required revision surgery for wound debridement and 2.9% of patients had a minor complication (i.e., a complication that required outpatient wound care and/or oral antibiotics to achieve complete resolution).[**23]** Ovaska reported an incidence of deep wound infections of 6.8% and that as risk for diabetes, alcohol consumption, fracture-dislocation, and associated soft tissue injuries.[**30]**

Surgical treatment is associated with higher AOFAS scores and lower VAS scores. In addition, while the rate of return to work and the occurrence of deep vein thrombosis is similar between the two treatment modalities, surgical treatment has a higher incidence of nerve damage and wound complications.[**39,40]**

Tomé-Bermejo, in 41 patients, reported 11 patients classified as having excellent results, 19 with good results, and nine with regular results; only one bad according to AOFAS criteria.[**3]** Other authors[**16-19]** place the figures of their results in values similar to those obtained in this study, all with a predominance of good results, higher than the results considered excellent.[**22,23]** Stockwell in 62 patients suffering from OTA/AO 44B fractures who underwent surgical treatment, revealed that the patients achieved an excellent result, in AOFA scores. AOFAS scores were significantly higher for patients undergoing surgical treatment than for those not undergoing surgery.[**1]**

Kortekangas applied surgical treatment to patients with stable Weber B fractures, achieving an Olerud-Molander score (OMAS) of 91.7 in a follow-up period of 52 weeks. Van Laarhoven involved 579 patients over a five-year observation period, advocated a surgical approach; The findings supported the limited use of implants in osteosynthesis.[**35-40]**

According to Pagliaro, the outcome of surgical treatment of ankle fractures is also related to the time of surgical intervention.[**27]** Early intervention is recommended to achieve anatomical reduction and stabilize the fracture. If possible, fractures should be definitively fixed within the first 24 hours. A delay of more than one week results in a significant increase in surgery-related complications, particularly soft tissue infections, which reduces functional outcome.

Conclusions

There was a predominance of two age peaks, one very marked in the male sex in our study, especially in the age groups between 18-49 years, and the other in women over 60 years, which is related to what is found in the literature. The body mass index (BMI) of the sample was mostly found in figures of 26 ± 3.7 Kg/m2, 18 patients with anticoagulant therapy. The anesthetic risk according to the ASA classification was low with 60 patients between ASA I and II, at a high rate of 84.5%. The results one year after the surgical intervention, in patients over 18 years of age diagnosed with ankle fracture, using as evaluators the AOFAS criteria, the visual pain scale and the incorporation into daily life activities, can be classified as excellent, with little residual pain and a very high return to daily life activities. The occurrence of complications was rare, some of which were related to the surgical procedure (cutaneous necrosis and loosening of the osteosynthesis material) and were related to morbid conditions associated with the age of the sample: previous anticoagulant therapy and osteoporosis. Complications not related to the surgical intervention, although they may occur in patients of any age, are more frequent in older adult patients.

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DOI:10.31579/2694-0248/120